limestone simultaneously with the precipitation of the metallic salts.

In chapter vi. a very interesting comparison is drawn between the silver-lead deposits of Eureka and those of Leadville and other localities in America and Europe, but no exact counterpart of these remarkable ore-bodies is anywhere discovered.

SEWERAGE AND HEALTH.

MR. ERWIN F. SMITH, in the Annual report of the Michigan state board of health, has shown the beneficial effects of thorough systems of sewerage on the health and mortality of cities. The work is based upon a large amount of data, chiefly drawn from European cities owing to the paucity and imperfection of American statistics. The author accepts the system of water-carriage as altogether the safest and best. A comparison of fifteen large cities without sewerage, with as many sewered, shows a remarkable difference in mortality. Thus in the first series the average death-rate was 35.8 per thousand inhabitants, while in the latter it was only 26. One of the most striking instances is that afforded by Chicago, where the death-rate has fallen off from 37.91 to 21.40, with the use of good water-sewerage. In the majority of cases, like results have been observed, and in only a few has the mortality remained unchanged. In England the decrease within late years in general mortality has been, perhaps, most noticeable, and in no country does sewerage receive greater attention. Most especially is there a direct connection observed between good sewerage and typhoid-fever and cholera. In Munich the mortality from the former of these causes has decreased from 1.82 to .17 per each thousand inhabitants. In Berlin, since 1879, the typhoid mortality has fallen off two-thirds; and it was further found, that, out of every 43 non-sewered houses, there was one death, as against 137 houses that were sewered. New York and Brooklyn have the best water-supply and general sewerage system of any of our large cities, and the death-rate from typhoid-fever has been correspondingly low, — in New York, during the last decade, only .28; and in Brooklyn, .15. Contrasting these figures with those of some large non-sewered cities, a remarkable difference is apparent. In Palermo and Turin, with defective water-supplies, the deaths from this cause were as many as 1.2 and .8. In St. Petersburg, without any proper disposition of sewage, the mortality was 1.06 in 1883, and .93 in 1884. It may be well to mention, that, in general, Russian mortality is frightfully high, in some provinces reaching 62 per thousand. With cholera similar results bring the conclusions that unsewered cities suffer severely, while sewered cities escape, and that localities subject to typhoid-fever are the ones likely to be visited by cholera. This last is especially significant, and behooves the earnest attention, at the present time, from American cities where the known typhoid mortality is great. As regards diphtheria, the author concludes from the study of abundant data that there is no direct relation between them. Finally, the author concludes that "it is entirely within bounds to say that the general introduction of proper sanitary measures, meaning thereby the provision of an abundant supply of pure water and the proper disposal of excreta, would reduce the annual loss in the United States from one single cause, the preventable typhoid-fever, in money value, at least $25,000,000 a year, — enough, in the course of a few generations, to sewer every city and village from the Atlantic to the Pacific."

The influence of sewerage and water-supply on the death-rate in cities. By E. F. SMITH. Lansing, *State*, 1885. 8°.

ABBOT'S SCIENTIFIC THEISM.

DR. ABBOT'S purpose is to expound a theory according to which the universe is the direct manifestation of the indwelling thought of God, — "a universe in which the adoring Kepler might well exclaim in awe unspeakable, 'O God! I think Thy thoughts after Thee,' — a universe which is the eternally objectified Divine Idea, illumining the human intellect, inspiring the human conscience, warming the human heart" (p. 214). This theory he regards as the best expression of the outcome of scientific thought, and he accordingly seeks to present his doctrine in close relation to the facts of scientific experience. Science, namely, discovers in the world objective relations, and finds these relations united in more or less completely understood groups or systems; science therefore, thinks Dr. Abbot, properly concludes that the world as a whole must be one rationally comprehensible system of relations. But a comprehensible system of relations is, he affirms, inconceivable apart from an intelligence that creates the system or that expresses itself in this system: hence the world must not only be intelligible, but intelligent; and therefore "the universe *per se* is an infinite self-consciousness" (p. 155). This, in the briefest summary, is Dr. Abbot's positive doctrine.

Organic scientific philosophy. Scientific theism. By FRANCIS ELLINGWOOD ABBOT, Ph.D. Boston, *Little, Brown & Co.*, 1885. 16°.

Nobody with the slightest knowledge of the annals of human thought ought to hesitate concerning where such a doctrine historically belongs, what line of philosophic tradition it represents, and upon what general considerations it must inevitably found itself, in case it gets any sound foundation at all. It is the well-known idealism of Plato, the immanent teleology of Aristotle, the doctrine that the continental schools of modern philosophy have from the first labored to comprehend, and to establish upon a modern foundation, the doctrine *par excellence* of post-Kantian idealism in Germany, and, in general, the contention of objective idealism everywhere: this it is that Dr. Abbot's book has somehow to present to us, and that every serious philosophic student would surely rejoice to find helpfully expounded and defended, with any new shading or emphasis, and with any new and significant method of proof. To the consistent believer in this objective idealism, the novelty of Dr. Abbot's argument must therefore lie — not in the main doctrine itself, which we all know so well and have toiled over so frequently, but in the form of the demonstration. We all are aware that science does undertake to know a real world, full of relations, and rationally intelligible; and all philosophical idealists of any significance whatsoever have been interested, ever since there were any sciences of experience, in proving at least two theses: 1°, that these sciences, in their assurance of the objective reality and thorough-going, rational intelligibility of the world, are absolutely and demonstrably right; and, 2°, that this right assurance, properly interpreted, makes of this real world of science nothing more nor less than the expression of an absolute intelligence, i.e., of an infinite spirit. This effort, we insist, all idealists of any significance have made, in their way and measure, from the first. Dr. Abbot will therefore be greeted by idealists as a welcome ally, if he adds a significant argument of his own.

As to his positive achievements, however, in this main undertaking, we feel no small disappointment. The link between that objective intelligibility of things which science postulates, and that objective conscious intelligence *in* things which Dr. Abbot, like all other objective idealists, wants to demonstrate, is a link that philosophy is bound to find if it can, but that cannot possibly be found, as Dr. Abbot at first undertakes to find it, by any bare experience of the facts of nature. The whole historical outcome of the philosophy of experience has shown that, and Dr. Abbot helps his case no whit by such scholasticism as he later employs, at the top of p. 151, where, having previously told us that scientific experience shows or postulates the universe, or the self-existent, to be 'infinitely intelligible,' he goes on thus:—

"That which is self-existent must be self-determined in all its attributes; and it could not possibly determine itself to be intelligble unless it were likewise intelligent. Self-existent intelligibility is self-intelligibility, and self-intelligibility is self-intelligence; or that which intelligibly exists *through* itself must be intelligible *to* itself, and therefore intelligent *in* itself."

All this, regarded as mere assertion, may be true, and in fact the present reviewer does most potently and powerfully believe it, although he holds it not fitting that it should be thus set down; for, thus set down, this kind of objective idealism is like sweet bells jangled, out of tune and harsh. But regarded not as bare assertion, but as argument, the statements as quoted take the form of an arrant scholasticism, and can convince nobody. Our author, in fact, only *feels* the connection between the objective intelligibility that science postulates, and the objective intelligence that philosophy seeks to demonstrate. He states this his feeling sometimes as a sort of vague inductive argument, to the effect that one has never found any thing but intelligence actually capable of making intelligible systems of things; and sometimes as a scholastic rambling from the word 'intelligible' to the word 'intelligent,' through various intermediate terms. In either form, however, the argument is unphilosophical and antiquated. The objective intelligibility of the world does indeed enable us rationally to conclude that the world contains objective intelligence; but we cannot so conclude through a mere induction, which would at once, like the old forms of the design argument, fall a prey to perfectly obvious sceptical objections; nor yet may we argue by means of a multitude of scholastic terms, and hope in that way to accomplish our purpose. We must take a little more trouble in philosophy than this. We must tread in certain paths of critical argument that Dr. Abbot, with all his idealistic enthusiasm, has studiously and very unphilosophically avoided, although many of them are very old facts in the history of idealism.

Space has forced us to be, we may fear, even discourteously brief in these remarks upon Dr. Abbot's positive doctrine; but, as to his historical and critical introduction to this doctrine, we despair of doing more than to suggest either its scope, or the thoughts that arise in us as we read it. Dr. Abbot is, on the whole, so thoughtful, so enthusiastic, so readable in spite of his terminology, so devout, so high-minded, so terribly in earnest, that it seems wicked impiety to say what

we fancy that nearly every reader of moderately good acquaintance with the history of thought will feel in going over this earlier portion of Dr. Abbot's book. Here is a scholar of undoubted learning and ability, who has himself a doctrine to advance, that, however he tries or fails to prove it, can only be described as the ancient objective idealism of the whole Platonic tradition in philosophy. He spends half his volume, however, in a violent denunciation of all idealists, whose method, he is convinced, could only lead logically to something known as solipsism. He sets over against them, as an example for their better instruction, the progressive realism of science, with its assurance that the world is there and is comprehensible, once for all. With this assurance, he thinks, philosophy must be set out, or else it must remain fruitless dreaming. The third alternative, however, the simple and obvious truth that philosophy rests neither upon an acceptance nor upon a rejection of such assumptions as this one, Dr. Abbot utterly forgets. Philosophy is in fact, at the very start, an effort to *comprehend* these assumptions of life and of science, and therefore cannot possibly begin by simply taking them as they are, unquestioned, just as it cannot possibly begin by casting them aside. It is highly comical, therefore, to find an accomplished philosophical student protesting against all writers who have ever asked *how* an individual consciousness can know a real world, and replying to their queries by the simple repetition of his personal assurance that we *do* know an external world. What, then, is philosophy there for, if not to answer, first of all, just the question, *How?* where common sense has contented itself with a bare *that?* How can a thinker of Dr. Abbot's experience be ignorant of this fundamental distinction between philosophizing about life, and living apart from philosophy? Life makes assumptions, and philosophy critically analyzes them; and that is precisely the cardinal point of difference in question. Now, empirical scientific investigation as such is just one form, though a very highly developed form, of living. It therefore does not reflect upon its own presuppositions. Why should it? But philosophizing is coming to self-consciousness about the foundation of your presuppositions. This work of merciless reflection must of course, in the beginning, take upon itself the sceptical form. Nothing is sacred to it: it is cold, dry, passionless, in spirit and in method. Yet its ultimate aim is not negation, nor yet scepticism, but clear consciousness, and nothing less than clear consciousness. Nobody is bound to pursue such an investigation unless he is so disposed; but for a professional philosopher himself to appear before us, ridiculing the very business of his art as necessarily worthless, produces a strange impression. It is as if a poet should begin by assuring us that all verse is a vain show and a wicked distortion of facts. Yet what else is all this introductory philippic of Dr. Abbot's but an abuse of the philosophers of former ages for having tried to philosophize? "The first objection to phenomenism," he writes, "is that science is actual knowledge of a noumenal universe, and therefore refutes by its bare existence" phenomenism (p. 79). "Noumenism," on the other hand, "is the only just and philosophical interpretation of the scientific method" (p. 127). The scientific method, moreover, is "the true and only organon for the discovery of truth; and the proof of its validity is the rapid progress of actual discovery" (p. 62). However, after all, "the truth of perception cannot be logically proved," as Dr. Abbot with charming simplicity remarks on p. 180, adding, "But if the wonderful increase of human knowledge by the use of the scientific method be not verification of the original scientific hypothesis [i.e., of the existence of a noumenal world], then there is no such thing as verification, and all human knowledge is a melancholy lie." These remarks are sufficient of themselves to characterize Dr. Abbot's not uncommon, but highly amusing state of mind. His philosophy thus rests upon two assertions, whereof the one is the statement that no truly fundamental philosophical reflection is needed at all, since 'the actual existence' of science is a sufficiently fundamental basis for our beliefs; while the other is the equally interesting statement that no fundamental philosophy is even possible, since "the truth of perception cannot be logically proved." The outcome of these two assertions of the uselessness and the impossibility of philosophy, is something that calls itself a 'philosophy of science,' and that announces itself as destined to revolutionize human thought about these matters. Its culmination in the 'Religion of science,' a truly beautiful and pious doctrine, for which of course it can give no sort of fundamental reason, we have already seen. In fine, then, Dr. Abbot's book gives us the positive theory that the objective idealists of the past discovered, held, and tried in a critical and thorough-going way, to demonstrate. This theory Dr. Abbot himself maintains by some very halting empirical arguments, and by a few scholastic word-puzzles. Those objective idealists of the past, however, he meanwhile fiercely upbraids, for that they, the wretches, in their tediously critical fashion, actually tried to get to the bottom of things, to discover fundamental principles, and even to demonstrate with philosophical thoroughness their positive doctrine and

his. The philosophy of the future will not act as they did, will cease to reflect upon the scientific assumptions, will take them merely on faith, with a few hints about the insanity of inquiring into them, and with a little melancholy contemplation of those dark ages when men used even to ask fundamental questions. In brief, the philosophy of the future will not philosophize.

Devotion and enthusiasm in the presence of the greater questions of religion and science are so rare that one rejoices to find any one so enthusiastic and devout as Dr. Abbot. But when he undertakes to discuss the philosophic questions proper, Dr. Abbot, by his ferocious denunciation of the whole past course of modern thought, reminds us of a certain newspaper musical critic, whose abuse of all the better concerts that he chances to attend we often have read with huge delight. The critic in question is, namely, by the will of an evil fortune, as accomplished and scholarly a musician as many years of toil could produce. Unhappily, however, it chances, that, by the will of God, his nature was so constituted that he hates music. The sorrows of this man are hard to conceive. JOSIAH ROYCE.

STOKES'S LECTURES ON LIGHT.

THE singular origin of these courses of lectures was described in this journal (vol. iii. p. 765) in the review of the first. Though by the same author as the first, the subjects treated are far more generally understood by the ordinary reader of scientific literature, and consequently hardly admit of such original treatment as characterized the former book. Of the four lectures here given, the first treats of phosphorescence and fluorescence; while the remainder, with the exception of a portion of the second lecture, which relates to the rotation of the plane of polarization, is devoted to spectrum analysis and its revelations. Perhaps the most interesting passage to the scientific reader occurs on p. 45, relating to the author's claims as an original discoverer of the principles of spectrum analysis. The warm discussions to which this topic have given rise are numerous, and, as is well known, some of the most eminent English writers have attributed the priority of the discovery, without restriction, to Stokes, leaving for Kirchhoff, beyond credit for an independent discovery, only the honor of having extended the method to the detection of elements in the sun other than sodium. Thus Tait, in his 'Recent advances in physical science,' and Sir William Thomson, in the President's address (*Brit. ass. rept.*, 1871). It was the latter which called out Zöllner's vigorous retort and arraignment of English men of science in the introduction to his 'Ueber die natur der cometen.' In this passage, after describing Foucault's observations on the spectrum of the electric arc, the author says, "On this ground, it seemed to me that the substance which exercised the selective absorption in Foucault's experiment must be free sodium. This might conceivably be set free from its compounds in the intense actions which go on in the sun or in the electric arc; but I had not thought that a body of such powerful affinities would be set free in the gentle flame of a spirit-lamp, nor perceived that the fact of that flame's emitting light of the definite refrangibility of D, entails, of necessity, that it should absorb light of that same refrangibility."

Burnett lectures on light. Second course, on light as a means of investigation. By GEORGE GABRIEL STOKES. London, *Macmillan*, 1885. 24°.

IN a recent paper by Prof. S. I. Smith (*Ann. mag. nat. hist.*) on the decapod (crabs, lobsters, etc.) crustaceans from the Albatross' dredgings in the North Atlantic, there are some interesting points brought out regarding the deep-water fauna. An unusually large number — a third — of all the species of decapods obtained were from depths greater than one thousand fathoms, and many of the species were remarkable for their large size. Specimens of one brachyuran had the carapace five inches long and six broad, while others of an anomuran were yet larger, the outstretched legs measuring over three feet in extent. Not only were there many large species, but there was an apparent absence of all small species. Their color was also found to be very characteristic. A few species were apparently nearly colorless, but the great majority were of some shade of red or orange, and there was no evidence of any other bright color. Of twenty-one abyssal species, eight possessed normal black eyes, two had abnormally small eyes, three had eyes with light-colored pigment, while of the rest the function was doubtful. Of five species from below two thousand fathoms, one had normal well-developed eyes, and the others small, imperfect, or doubtful. From these facts, in connection with others, the author concludes, that, despite the objections of physicists, some light probably penetrates even beyond two thousand fathoms; and he thinks, from the purity of the water in mid-ocean, light might reach this depth as readily as to five hundred, or even two hundred, nearer shore. However, he finds that there is an undoubted tendency towards radical modification or obliteration of the normal visual organs in deep-water species. The large size and small number of eggs were also observed as a marked characteristic of many deep-sea decapods.